WHAT IS CLAIMED IS:

1. A plasma processing method, in which a process gas is introduced into an evacuated process chamber for subjecting a target object to a plasma processing, comprising:

introducing again at least a part of the process gas exhausted from said process chamber into said process chamber;

obtaining specified values by monitoring the state of the plasma of the process gas within the process chamber; and

controlling the introducing conditions of the process gas into the process chamber so as to adjust a predetermined property value to a regulated value.

2. The plasma processing method according to claim 1, wherein said introducing conditions of the process gas is controlled by changing a circulating ratio, which is a ratio of the flow rate of the process gas introduced again into said process chamber to the flow rate of entire gas introduced into the process chamber, and said predetermined property value is a property value allowing the change in the state of the plasma accompanying the change in said circulating ratio to be correlated to process characteristics of said target object.

3. The plasma processing method according to claim 2, wherein the introducing conditions of said

process gas is controlled by controlling the flow rate of the process gas introduced again into said process chamber.

4. The plasma processing method according to claim 2, wherein the introducing conditions of said process gas is controlled by controlling the flow rate of the process gas newly introduced into said process chamber.

5. The plasma processing method according to claim 4, wherein said process gas newly introduced into said process chamber is a mixed gas comprising at least two kinds of gases, and the flow rate of the process gas newly introduced into the process chamber is controlled by controlling the flow rate ratio of the components of said mixed gas.

6. The plasma processing method according to claim 2, wherein said target object is a silicon oxide film formed on a silicon substrate; said silicon oxide film is processed by a plasma processing; and said regulated value is said property value obtained before changing said circulating ratio.

7. The plasma processing method according to claim 6, wherein said regulated value is said property value when said circulating ratio is zero.

8. The plasma processing method according to claim 2, wherein said process chamber is a chamber after deposition of a silicon oxide film on a

substrate; said target object is a silicon oxide film attached to the inner wall of said process chamber; said silicon oxide film is removed by said plasma processing; said process characteristics represent the removal rate of said silicon oxide film; and said regulated value is said property value representing that said removal rate is the maximum.

9. The plasma processing method according to claim 8, wherein said process gas is a gaseous mixture containing C and F, and said property value represents the light emission intensity of SiF_4.

10. The plasma processing method according to claim 2, wherein at least a part of the process gas exhausted from said process chamber is introduced again into said process chamber without adjusting substantially the components of said process gas.

11. A plasma processing method, in which a process gas is introduced into an evacuated process chamber for subjecting a target object to a plasma processing, comprising:

introducing again at least a part of the process gas exhausted from said process chamber into said process chamber;

obtaining specified values by monitoring the state of the plasma of the process gas within the process chamber; and

controlling the introducing conditions of the

process gas into the process chamber so as to adjust a predetermined property value to a regulated value;

wherein said predetermined property value is a property value allowing the change in the state of the plasma in changing the circulating ratio, which is a ratio of the flow rate of the process gas introduced again into the process chamber to the flow rate of the entire process gas introduced into the process chamber, to be correlated to the process characteristics of the target substrate; and

said regulated value represents said property value obtained before changing the circulating ratio.

12. The plasma processing method according to claim 11, wherein the introducing conditions of said process gas are controlled by controlling the flow rate of the process gas introduced again into said process chamber.

13. The plasma processing method according to claim 11, wherein the introducing conditions of said process gas are controlled by controlling the flow rate of the process gas newly introduced into said process chamber.

14. The plasma processing method according to claim 11, wherein said process gas newly introduced into said process chamber is a mixed gas comprising at least two kinds of gaseous components; and the flow rate of the process gas newly introduced into said

process chamber is controlled by controlling the flow rate ratio of the components of said mixed gas.

15. The plasma processing method according to claim 11, wherein said process gas introduced into the process chamber contains a gaseous component having C and F; a silicon oxide film that is processed by an etching is formed on the surface of said target substrate; and said property value represents the intensity of the light emission from CF_2 radicals.

16. The plasma processing method according to claim 11, wherein at least a part of the process gas exhausted from said process chamber is introduced again into the process chamber without adjusting substantially the components of the process gas.

17. The plasma processing method according to claim 11, wherein said regulated value represents said property value when said circulating ratio is zero.

18. A plasma processing method, in which a process gas is introduced into an evacuated process chamber for forming a thin film on the surface of a target object, comprising:

introducing again at least a part of the process gas exhausted from said process chamber into said process chamber while processing a thin film formed of the same material;

monitoring the rate of change in the thickness of the thin film formed on the surface of said target

substrate within said process chamber; and

controlling the introducing conditions of the process gas into the process chamber in changing the circulating ratio of the process gas into the process chamber so as to allow the rate of change in the thickness of said thin film to form a regulated value;

wherein said regulated value is a rate of change in the thickness of the thin film obtained before changing the circulating ratio.

19. The plasma processing method according to claim 18, wherein the rate of change in the thickness of said thin film is measured by monitoring the state of the plasma of the process gas within said process chamber.

20. The plasma processing method according to claim 19, wherein the introducing conditions of said process gas are controlled by controlling the flow rate of the process gas introduced again into the process chamber.

21. The plasma processing method according to claim 19, wherein the introducing conditions of said process gas are controlled by controlling the flow rate of the process gas newly introduced into the process chamber.

22. The plasma processing method according to claim 19, wherein the process gas newly introduced into said process chamber is a mixed gas containing at least

two kinds of gaseous components; and the flow rate of the newly introduced process gas is controlled by controlling the flow rate ratio of the gaseous components of said mixed gas.

23. The plasma processing method according to claim 19, wherein said process gas introduced into the process chamber contains a gaseous component having C and F; a silicon oxide film that is processed by an etching is formed on the surface of said target substrate; and said property value represents the intensity of the light emission from CF_2 radicals.

24. The plasma processing method according to claim 19, wherein at least a part of the process gas exhausted from said process chamber is introduced again into the process chamber without adjusting substantially the components of the process gas.

25. The plasma processing method according to claim 19, wherein said regulated value represents the rate of change in the thickness of said thin film when said circulating ratio is zero.

26. A plasma processing method, in which a process gas is introduced into an evacuated process chamber so as to process a thin film on the surface of a target substrate, comprising:

introducing again at least a part of the process gas exhausted from said process chamber into said process chamber;

monitoring the rate of change in the thickness of a thin film formed on the surface of said target substrate within said process chamber; and

controlling the introducing conditions of the process gas into the process chamber in changing the circulating ratio of the process gas introduced again into the process chamber so as to adjust the rate of change in the thickness of the thin film to a regulated value;

wherein said regulated value is the rate of change in the thickness of said thin film obtained before changing the circulating ratio.

27. The plasma processing method according to claim 26, wherein the change in said circulating ratio is brought about by changing the flow rate of the process gas newly introduced into said process chamber.

28. The plasma processing method according to claim 26, wherein the change in said circulating ratio is brought about by changing the flow rate of the process gas introduced again into said process chamber.

29. The plasma processing method according to claim 26, wherein said process gas introduced into the process chamber contains a gaseous component having C and F; a silicon oxide film that is processed by an etching is formed on the surface of said target substrate; and said property value represents the intensity of the light emission from CF_2 radicals.

30. The plasma processing method according to claim 26, wherein at least a part of the process gas exhausted from said process chamber is introduced again into the process chamber without adjusting substantially the components of the process gas.

31. The plasma processing method according to claim 26, wherein said regulated value represents the rate of change in the thickness of said thin film when said circulating ratio is zero.